THE EFFECT OF REPLACEMENT OF SOYABEAN MEAL WITH BLOOD MEAL ON THE GROWTH OF MUDFISH *Clarias anguillaries* (L) FINGERLINGS

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ABSTRACT

Blood meal and full fat soyabean meal were mixed in different proportions to give 0%, 10%, 25%, 50%, 75%, 90%, and 100% meal in the protein fraction of the diet and fed to *Clarias anguillaris* fingerlings in floating hapas. The growth performance of the fingerlings were monitored for 84 days. At the end of the experiment the mean weight of the fingerlings increased with increase in the level of blood meal up to 50% blood meal in the diet after which there was a decline in the mean weight of the fish. This same level of blood meal gave the best specific growth rate, feed conversion efficiency and protein efficiency ratio. Thus the nutritive value of blood meal was enhanced by the addition of an equal level of full fat soyabean meal in the diet.

INTRODUCTION

Soyabean meal is unique among the plant source protein in that it is rich in the essential amino acids although the level of methionine is suboptimal (Nose, 1979). Supplementation of soyabean meal with animal proteins is necessary to bring the amino acid profile of the feed into proper balance.

Blood meal could be used to blend with soyabean meal in fish feed because it is high in protein although low in isoleucine (Harris, 1990). A combination of soyabean which is high in isoleucine with blood meal should meet the essential amino acid requirement. Studies have shown that blood meal can be well utilized by fish (Fowler and Banks, 1976; Dekimpe and Micha, 1974; Ufodike and Ugwuzor, 1985). Besides blood meal is usually discarded in slaughter houses and therefore costs nothing Ufodike and Ugwuzor, 1985).

The aim of this experiment was to determine the growth rate of food utilization of *Clarias anguillaris* fingerlings fed different levels of blood meal and soyabean meal in an isocaloric diet. This experiment will enable fish nutritionists select the best combination of blood meal and soyabean meal in the ration that would give optimal growth of *C. anguillaris* fingerlings fed different levels of blood meal and soyabean meal in an isocaloric diet. This experiment will enable fish nutritionists select the best combination of blood meal and soyabean meal in the ration that would give optimal growth of *C. anguillaris* in outdoor tanks.

MATERIALS AND METHODS

The experiment was conducted in the fish hatchery complex of NIFFR, New Bussa using one outdoor concrete tank measuring 10x10x2m. 320 *C. anguillaris* fingerlings having mean weight ranging from 2.86±0.30 to 3.66±0g were placed in 16 hapas measuring 1x1x1 metre suspended in the concrete tank.

Preparation of protein supplements fish meal

Tilapia were collected from the reservoir and boiled for about 90 mins. The cooked fish were dried in the sun before grinding to powder in a hammer mill.

Blood meal

Fresh cow blood was collected from the abattoir and boiled. The boiled blood was dried in the sun and ground in the hammer mill.

Soyabean meal

Raw soyabean were toasted for 30 minutes in the oven at 100°C to destroy the trypsin inhibitor and improve the nutritive value (Eyo, 1990). The toasted soyabean were broken to smaller particles in a hammer mill to remove the hull and later ground into powder.

Feed and Feeding

The composition of the diet is shown in Table I. The blood meal and full fat soyabean meal were mixed in different proportions to give 0%, 10%, 25%, 50%, 75%, 90%, 100%, blood meal in the protein fraction of the diet. The difference was made up with soyabean meal. Other ingredients shown in the table were mixed together in hot water to form a consistent dough. The dough was then pelleted using a domestic hand pelleter with 3mm die. The pellets were dried in the oven at a temperature of 50°C to evaporate the moisture before use. A total of eight feed mixtures were prepared and diet 8 containing fish meal as the only protein source was taken as control (Table 1).

Twenty-five Mudfish fingerlings were acclimated in each of 16 hapas for one week during which time the fish were not fed with prepared rations.

Feeding with the experimental rations commenced after the initial weight of the fish were taken. Subsequent measurements were taken fortnightly at which time the feed weight was also adjusted accordingly. Fish were fed at 5% biomass per day, twice daily, 9.30 am and 4.30pm. The hapas were thoroughly washed biweekly to remove algae from the hapas and allow uninterrupted flow of water through the hapas. The experiment was monitored for 84 days.

Chemical Analysis

Crude protein was analysed according to AOAC (1990).

Food Utilization Parameters

The food utilization parameters applied were specific growth rate, food conversion efficiency and protein efficiency ratio.

Physico-chemical parameters

The dissolved oxygen (D0), temperature and pH of the water in the concrete tank were measured weekly using standard methods (APHA, 1981).

Statistical Analysis

Statistical analysis was carried out with the computer (Tandy 400 LX) using Duncan's multiple range test.

RESULTS

Growth Performance

Table 2 shows the growth performance of *C anguillaris* fingerlings fed various levels of blood meal in the soyabean diet. The initial mean weight varied between 2.86±0.30g and 3.66±0g. There was no significant difference in the initial mean weight of the fingerlings (P>0.05), while in the final mean weight significant differences were obtained (P¾0.05). This shows that the different feed mixtures had different effects on the growth of the fingerlings. These differences were manifested in the mean weight gain of the experimental fish. The least mean weight gain was observed in fish fed diet 2. There was no significant difference (P>.0.5) in the mean weight gain of fish fed diet 1,2 and 6. Similarly, no significant difference was obtained in fingerlings fed diets 3, 4 and 5. Fingerlings fed diet 8 had the highest mean weight gain (9.19±1.68g) which was significantly different (P< ¾ 0.05) from those fed other diets.

The percentage weight gain of the experimental fish was similarly affected by the diet intake. No significant difference (P>0.05) was obtained in the percentage weight gain of fingerlings fed diets 1, 2, 6 and 7. Also no significant difference was observed in mudfish fingerlings fed diets 3,4 and 5 (P>0.05). Signifificant difference (P<0.05) was obtained in the percentage weight gain of fingerlings fed diet 8 which also scored the highest percentage weight gain (284%).

Specific Growth Rate (SGR)

The highest SGR was recorded in fish fed the control ration (diet 8) (1.60) followed by those fed diet 4 (1.23). The least SGR of 0.63 was recorded among fingerlings fed diet 2. This SGR was not significantly different (P>0.05) from that of fingerlings fed diet 1 (0.76). No significant

Table 1: Composition of experimental diets (g/100g).

	DIET COMPOSITION							
INGREDIENTS	DT1	DT2	DT3	DT4	DT5	DT6	DT7	DT8
Soyabean meal	62	55.8	46.5	31	15.5	6.2	0	-
Fish meal	-	-	-	-	-	-	-	51
Blood meal	0	6.2	15.5	31	46.5	55.8	36.5	-
Yellow maize	34	34	34	34	34	34	59.5	45
Cod Liver Oil+	2	2	2	2	2	2	2	2
Vitamin/Mineral Premix+	2	2	2	2	2	2	2	2
Total	100	100	100	100	100	100	100	100
Computed crude protein %	33.16	35.50	39.05	50.83	54.36	37.34	37.34	35.30
Analysed crude protein %	32.02	34.52	37.15	48.53	52.79	37.05	37.05	34.78

+ Composition as in the Appendix

Table 2: Growth performance of mudfish fingerlings fed blood I meal diet for 84 days.

Feed	Initial mean wt(g)± SD	Final mean wt (g)±SD	Mean weight gain (g)±SD	% Weight gain (g)	Specific Conversion efficiency	Food Conversion efficiency	Protein efficiency Ratio	Mortality %
1	$3.11^{a} \pm 1.08$	$5.71^{a} \pm 0.13$	$2.60^{a} \pm 1.22$	83.60^{a}	0.76^{a}	4.42^{a}	0.33^{a}	2.5
2	$3.54^{a} \pm 0.04$	$6.06^{a} \pm 0.06$	$2.52^{a} \pm 0.02$	71.18^{a}	0.63^{a}	9.14^{a}	0.28^{a}	2.5
3	$3.65^{a} \pm 0.05$	$9.21^{b} \pm 3.52$	$5.56^{b} \pm 3.61$	152.32^{b}	1.02^{b}	20.27^{b}	0.59^{b}	2.5
4	$3.66^{a} \pm 0$	$10.98^{c} \pm 5.20$	$7.32^{b} \pm 5.20$	200.00^{b}	1.23^{c}	33.47^{c}	0.76^{c}	5.0
5	$3.61^{a} \pm 0.05$	$8.67^{b} \pm 0.61$	$5.06^{b} \pm 0.66$	400.16^{b}	1.04^{b}	31.60^{c}	0.62^{c}	5.0
6	$3.60^{a} \pm 0.04$	$7.90^{b} \pm 0.62$	$4.3^{a} \pm 0.65$	119.44^{a}	0.93^{b}	22.97^{b}	0.62^{c}	5.0
7	$2.86^{a} \pm 0.30$	$5.72^{a} \pm 0.45$	$2.86^{a} \pm 1.56$	100.00^{a}	0.82^{b}	12.35^{d}	0.32^{a}	10.0
8	$3.23^{a} \pm 0.04$	$12.42^{d} \pm 1.64$	$9.19^{c} \pm 1.68$	284.52^{c}	1.60^{d}	34.89^{c}	0.05^{c}	2.5

None: Values in the same vertical line followed by the same letters are not significantly different ($P > 0.05$)
SD = Standard Deviation.

difference was obtained in the SGR of mudfish fingerlings fed diets 5, 6 and 7 (P>0.06).

Feed Conversion Efficiency (FCE)

The FCE was generally low for *C. anguillaris* fingerlings fed diets 1 and 2 (9.42 and 9.14 respectively). The highest FCE was recorded in fingerlings fed the control ration (34.89). This was not significantly different from those fed diets 4 and 5. The FCE of those fed diets 3 and 6 were not significantly different (P>0.05). The FCE of fingerlings fed diet 7 was significantly different from those fed diets 6 and 8 (P<0.05).

Protein Efficiency Ratio (PER)

The PER was lowest in fingerlings fed diet 2 although this was not significantly different (P>0.05) from those fed diets 1,6 and 7. Those fed the control ration (diet 8) recorded the highest PER followed by those fed diet 4 and 5 respectively. The PER of fingerlings fed diet 3 were significantly different from those fed the other diets (P<0.05).

Physico-chemical parameters

Table 3 shows the water quality variables in the experimental outdoor tank. The water temperature ranged from 23.0°C to 28.7°C with a mean of 25.89°C ± 2.10°C while the pH ranged from 7.4°C to 7.9°C with a mean of 7.62° ± 0.17°C. The dissolved oxygen was between 5.0 to 6.9 mg/l. The physico-chemical parameters were considered suitable for the culture of *C. anguillaris*.

Table 3: Water quality variables in the experimental outdoor tank.

Parameters	Range	Mean ± SD
Temperature °C	23.0 - 28.7	25.9±2.10
pH	7.4 - 9.9	7.6±0.17
Dissolved Oxygen (DO) mg/l	5.0 - 6.9	5.8±0.6

Mortality

The percentage mortality was generally low (2.5%) for mudfish fingerlings fed the control diet and diets 1,2 and 3; but rose in fish fed diets 4 to 6 (5-7.5%). The highest percentage mortality of 10% was recorded among fish fed diet 7 (containing 100% blood meal).

DISCUSSION

The results indicate an increase in the weight gain and food utilization by *C. anguillaris* fingerlings with rise in the percentage blood meal in the soyabean diet up to 50% blood meal. Beyond the 50% level of blood meal, a significant reduction in the growth performance of the fingerlings was observed (Figure 1). Compared with soyaben meal and indeed other protein sources, blood meal has more than 80% protein (Oyenuga, 1968; Miller, 1976; Raven and Walker, 1980). This is in contrast with soyabean meal which has 48% protein (Raven and Walker, 1980, Eyo 1990). This high protein level in blood meal was also reflected by the high crude protein level in the high blood meal rations. This shows that beyond 50% replacement of blood meal, the growth rate of the fingerlings was inversely proportional to the dietary blood meal level. This poor performance of fingerlings on high inclusion of blood meal in the diet could be traced to imbalance in the amino acid composition of blood meal. Blood meal is low in isoleucine (Harris, 1980), which could be responsible for the poor performance of *C. anguillaris* fed high blood meal diets. The protein content of the high blood meal diets were generally higher than the protein requirement of *Clarias* sp fingerlings (Faturoti *et al.*, 1986; Madu, 1989). The high protein content in the high blood meal diets could produce stress due to excess of ammonia released from the gills (Hastings, 1976). This could result in poor growth rate of the fingerlings.

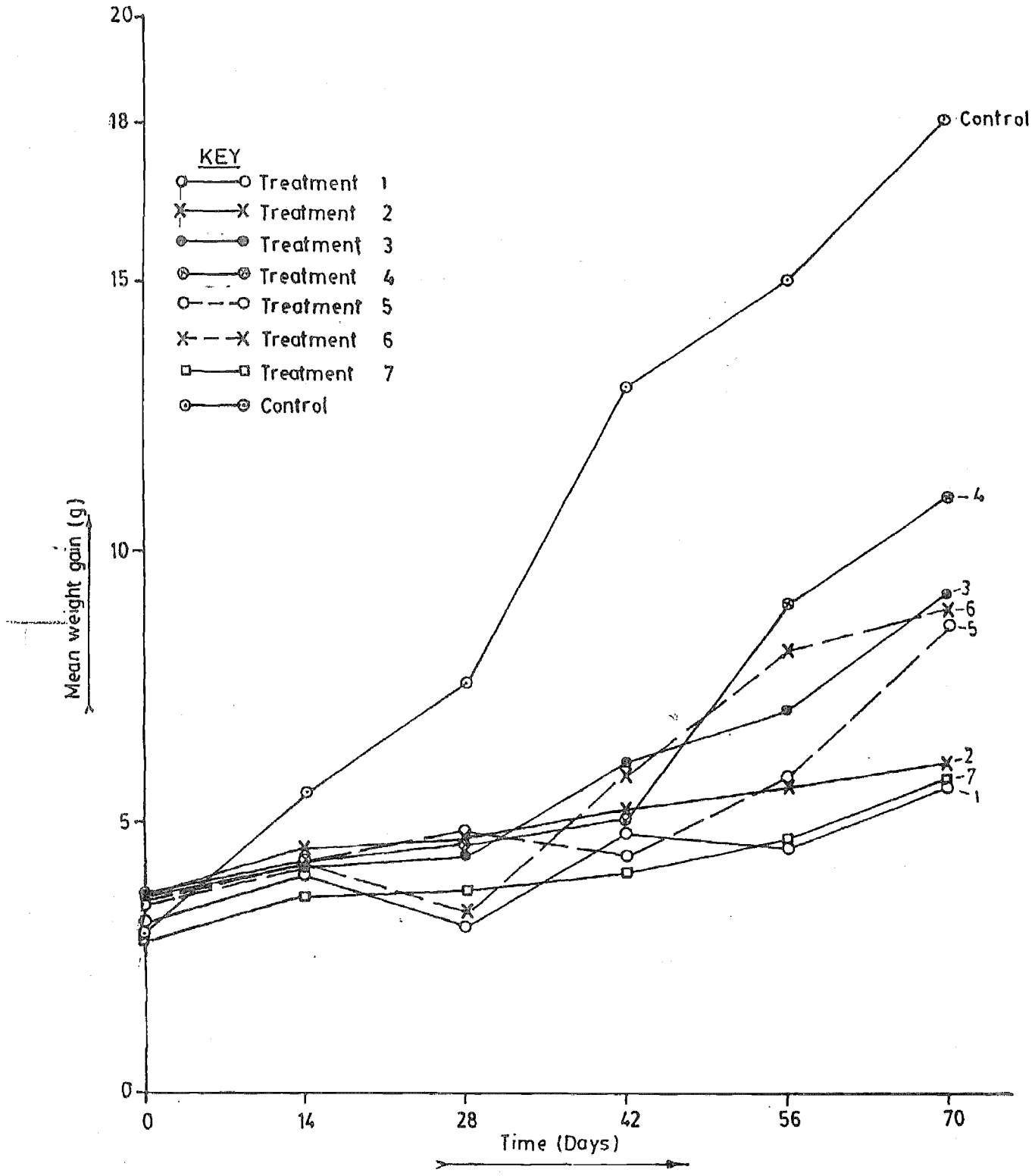

Fig 1. Growth of C.anguillaris fingerlings fed different dietary levels of Soyabean meal and blood meal.

The poor growth rate of fish fed the highest amount of blood meal was also observed in tilapia *Oreochromis niloticus* (Ufodike and Uguzor, 1985; Otubusin, 1987). Fowler and Banks (1976) also demonstrated that blood meal fed at 5.8% of the diet as a partial replacement for herring meal produced increased fish growth, and as high as 11.6% of blood meal could be incorporated into diet with growth comparable to those of controls.

It was observed that fish fed the highest levels of blood meal recorded the highest mortality in the hapas. Whether this high mortality was caused by a nutritional defect in the diet was not clear. However, it has been reported that blood meal is unpalatable to most livestock hence it is not popular in protein supplement of livestock feeds (Cullision, 1979). This might further explain the poor growth rate of fish fed the high blood meal diets. However, inclusion of low levels of blood meal in soyabean diet will improve the growth rate of *C. anguillaris* without deleterious effect on the fish.

In general the combination of 50% blood meal and 50% soyabean diet gave the best mean weight gain, best specific growth rate, best feed conversion efficiency and protein efficiency ratio compared with all other treatments. This shows that the nutritive value of blood meal is enhanced by the addition of an equal level of soyabean meal in the diet. Thus the combination of blood meal and soyabean meal has a higher effective biological value than soyabean meal alone (Harris, 1980).

CONCLUSION

C. anguillaris fingerlings could utilize up to 50% blood meal in the soyabean diet for growth. Beyond this level of substitution the growth of the fingerlings was reduced. Inclusion of high levels of blood meal in the diet of *C. anguillaris* should be avoided to prevent high mortality of fingerlings.

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APPENDIX

Composition of Vitamin/Mineral Premixes and Cod Liver Oil
A. Vitamin and Mineral Premixes Embavit No. 9 - Poultry Grower May and Baker Nigeria Limited

(i) Vitamins

Ingredient	Content per 100 grams
Vitamin A	400,000 (I.U)
Vitamin D_3	80,000 (I.U.)
Vitamin B_1	0.02
Vitamin D_2	0.16
Nicotinic Acid	0.8
Calcium Pantothenate	0.4
Vitamin D_{12}	0.02
Vitamin K_3	0.8
Vitamin E	0.8
Folic Acid	0.02
Choline chloride	0.1

(ii) Minerals

Cobalt	0.16
Copper	0.32
Iron	0.28
Iodine	0.32
Manganese	2.56
Zinc	16.0
Selenium	0.00064
BHT	0.2

B. Cod Liver Oil (Seven seas brands

Ingredient	Content per cm^3
Vitamin A	700 I.U
Vitamin D	80.I.U
Vitamin E	0.1